IN THE CLAIMS:

Please add Claims 27 through 79 as follows:

--27. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading the image to an observer's eyeball;

said ocular optical system comprising first, second and third surfaces, in which a space defined by said first, second and third surfaces is filled with a medium having a refractive index larger than 1;

said first, second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, a first surface serving as both a refracting surface and an internally reflecting surface, a second surface serving as a refracting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and a third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least three surfaces having a finite curvature radius;

wherein any one of said first, second and third surfaces is a decentered aspherical surface;

wherein any one of said first, second and third surfaces is an anamorphic surface;

wherein said optical apparatus satisfies the following condition in a case where a vertical plane containing said observer's visual axis is defined as a YZ-plane, and a horizontal plane perpendicular to the YZ-plane is defined as an XZ-plane:

$$1 < |R_{y2}/R_{x2}| \leq 1.21$$

where R_{y2} is a curvature radius of said second surface in the YZ-plane, and R_{x2} is a curvature radius of said second surface in the XZ-plane.

cont'd

28. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading the image to an observer's eyeball;

said ocular optical system comprising first, second and third surfaces, in which a space defined by said at least first, second and third surfaces is filled with a medium having a refractive index larger than 1;

said first, second and third surfaces including, in order from observer's eyeball side toward said device for displaying an image, a first surface serving as both a refracting surface and an internally reflecting surface, a second surface serving as a reflecting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and a third

surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surfaces having a finite curvature radius;

wherein any one of said first, second and third surfaces is a decentered aspherical surface;

wherein any one of said first, second and third surfaces is an anamorphic surface;

wherein said optical apparatus satisfies the following condition in a case where a vertical plane containing said observer's visual axis is defined as a YZ-plane, and a horizontal plane perpendicular to the YZ-plane is defined as an XZ-plane:

$$1 < |R_{y2}/R_{x2}| \leq 1.921$$

where R_{y2} is a curvature radius of said second surface in the YZ-plane, and R_{x2} is a curvature radius of said second surface in the XZ-plane,

wherein internal reflection that is performed by said first surface is total reflection.

29. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading the image to an observer's eyeball,

said ocular optical system comprising first, second and third surfaces, in which a space defined by said at least first, second and third surfaces is filled with a medium having a refractive index larger than 1,

said first, second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, a first surface serving as both a refracting surface and an internally reflecting surface, a second surface serving as a reflecting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and a third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surfaces having a finite curvature radius; and

wherein said first surface is a reflecting surface having a convex surface directed toward said second surface.

30. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image and for leading the image to an observer's eyeball,

said ocular optical system comprising first, second and third surfaces, in which a space defined by said at least first, second and third surfaces is filled with a medium having a refractive index larger than 1,

said first, second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, a first surface serving as both a refracting surface and an internally reflecting surface, a second surface serving as a reflecting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and a third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surfaces having a finite curvature radius;

wherein internal reflection that is performed by said first surface is total reflection, and

wherein said first surface is a reflecting surface having a convex surface directed toward said second surface.

31. An optical apparatus according to claim 29 or 30, wherein either one of said first and third surfaces of said ocular optical system is tilted or decentered with respect to said observer's visual axis.

32. An optical apparatus according to claim 31, further comprising means for positioning both said device for displaying an image and said ocular optical system with respect to an observer's head.

33. An optical apparatus according to claim 31, further comprising means for supporting both said device for displaying an image and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

34. An optical apparatus according to claim 31, further comprising means for supporting a pair of said optical apparatuses at a predetermined spacing.

35. An optical apparatus according to claim 31, wherein said ocular optical system is used as an imaging optical system.

36. An optical apparatus according to claim 31, which satisfies the following condition:

θ=27.50, 30.50, 26.50, 28.16, 18.72 or 26.02

where θ is an angle between said visual axis and a line normal to said second surface of said ocular optical system in the vicinity of an intersection between said observer's visual axis and said second surface.

37. An optical apparatus according to claim 36, further comprising means for positioning both said device for displaying an image and said ocular optical system with respect to an observer's head.

38. An optical apparatus according to claim 36, further comprising means for supporting both said device for displaying an image and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

39. An optical apparatus according to claim 36, further comprising means for supporting a pair of said optical apparatuses at a predetermined spacing.

40. An optical apparatus according to claim 36, wherein said ocular optical system is used as an imaging optical system.

41. An optical apparatus according to claim 36, wherein said device for displaying an image has a display surface which is tilted with respect to said observer's visual axis.

42. An optical apparatus according to claim 41, further comprising means for positioning both said device for displaying an image and said ocular optical system with respect to an observer's head.

43. An optical apparatus according to claim 41, further comprising means for supporting both said device for

displaying an image and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

44. An optical apparatus according to claim 41, further comprising means for supporting a pair of said optical apparatuses at a predetermined spacing.

45. An optical apparatus according to claim 41, wherein said ocular optical system is used as an imaging optical system.

46. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading said image to an observer's eyeball,

said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium having refractive index larger than 1,

said device for displaying an image being disposed at a position facing said third surface,

said first, second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, said first surface serving as both a

refracting surface and an internally reflecting surface, said second surface serving as a reflecting surface of a positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surfaces having a finite curvature radius,

wherein any one of said first, second and third surfaces is a decentered aspherical surface,

wherein any one of said first, second and third surfaces is an anamorphic surface, and

said optical apparatus satisfies the following condition in a case where a vertical plane containing said observer's visual axis defined as a YZ-plane, and a horizontal plane perpendicular to said YZ-plane is defined as an XZ-plane:

$$1 < |R_{y2}/R_{x2}| \leq 1.921$$

where R_{y2} is a curvature radius of said second surface in said YZ-plane, and R_{x2} is a curvature radius of said second surface in said XZ-plane.

47. An optical apparatus according to claim 46, further comprising means for positioning both said device for displaying an image and said ocular optical system with respect to an observer's head.

48. An optical apparatus according to claim 46, further comprising means for supporting both said device for displaying an image and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

49. An optical apparatus according to claim 46, further comprising means for supporting a pair of said optical apparatuses at a predetermined spacing.

50. An optical apparatus according to claim 46, wherein said ocular optical system is used as an imaging optical system.

51. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading said image to an observer's eyeball,

said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium having a refractive index larger than 1,

said device for displaying an image being disposed at a position facing said third surface,

said first, second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, said first surface serving as both a refracting surface and an internally reflecting surface, said second surface serving as a reflecting surface of a positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surface having a finite curvature radius,

wherein internal reflection that is performed by said first surface is total reflection, wherein any one of said first, second and third surfaces is a decentered aspherical surface,

wherein any one of said first, second and third surfaces is an anamorphic surface, and

said optical apparatus satisfies the following condition in a case where a vertical plane perpendicular to the YZ-plane is defined as a YZ-plane, and a horizontal plane perpendicular to said YZ-plane is defined as an XZ-plane:

$$1 < |R_{y2}/R_{x2}| \leq 1.921$$

where R_{y2} is a curvature radius of said second surface in said YZ-plane, and R_{x2} is a curvature radius of said second surface in said XZ-plane.

52. An optical apparatus according to claim 51, further comprising means for positioning both said device for displaying an image and said ocular optical system with respect to an observer's head.

53. An optical apparatus according to claim 51, further comprising means for supporting both said device for displaying an image and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

54. An optical apparatus according to claim 51, further comprising means for supporting a pair of said optical apparatuses at a predetermined spacing.

55. An optical apparatus according to claim 51, wherein said ocular optical system is used as an imaging optical system.

56. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading said image to an observer's eyeball,

said ocular optical system comprising at least first, second and third surfaces, in which a space defined by

said surfaces is filled with a medium having a refractive index larger than 1,

said device for displaying an image being disposed at a position facing said third surface,

said first second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, said first surface serving as both a refracting surface and an internally reflecting surface, said second surface serving a reflecting surface of a positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surfaces having a finite curvature radius,

wherein said first surface is a reflecting surface having a convex surface directed toward said second surface.

57. An optical apparatus comprising:

a device for displaying an image; and

an ocular optical system for projecting an image formed by said device for displaying an image and for leading said image to an observer's eyeball,

said ocular optical system comprising at least first, second and third surfaces, in which a space defined by

said surfaces is filled with a medium having a refractive index larger than 1,

said device for displaying an image being disposed at a position facing said third surface,

said first, second and third surfaces including, in order from an observer's eyeball side toward said device for displaying an image, said first surface serving as both a refracting surface and an internally reflecting surface, said second surface serving as a reflecting surface of a positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said device for displaying an image, at least two of said at least first, second and third surfaces having a finite curvature radius,

wherein internal reflection that is performed by said first surface is total reflection, and

wherein said first surface is a reflecting surface having a convex surface directed toward said second surface.

58. An optical apparatus according to claim 56 or 57, further comprising means for positioning both said device for displaying an image and said ocular optical system with respect to an observer's head.

59. An optical apparatus according to claim 56 or 57, further comprising means for supporting both said device for displaying an image and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

60. An optical apparatus according to claim 56 or 57, further comprising means for supporting a pair of said optical apparatuses at a predetermined spacing.

61. An optical apparatus according to claim 56 or 57, wherein said ocular optical system is used as an imaging optical system.

62. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and a toric aspherical surface (TAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}}{1+\sqrt{1-(1+k_i)(y/r_{yi})^2}} + A_i y^4 + B_i y^6 + C_i y^8 + D_i y^{10}$$

where k_i, A_i, B_i, C_i, and D_i are aspherical coefficients,

said optical apparatus has the following properties:

	r_{yi}[mm] radius of curvature in generatrix direction	r_{xi}[mm] radius of curvature in meridian direction	y, z coordinates of vertex		tilt angle in generatrix direction	
i=1	∞		(0、0)		0	
2	-548.019	-74.077	(-0.05、19.80)	TAL	0	in prism
3	-57.595	-40.526	(5.10、29.14)	TAL	-22	in prism
4	-548.019	-74.077	(-0.05、19.80)	TAL	0	in prism
5	∞		(18.58、28.07)		68.90	in prism
6	∞		(21.38、29.15)		51.17	

	K_2、K_4	A_2、A_4	B_2、B_4	C_2、C_4	D_2、D_4
(TAL2、4)	613.869	-0.473E-5	0.326E-7	-0.940E-10	0.991E-13

	K_3	A_3	B_3	C_3	D_3
(TAL3)	-1.360	0.345E-5	-0.301E-7	0.944E-10	-0.113E-12

refractive index (d-line) of prism	1.49171	focal length in generatrix direction	f_y=21.07mm
Abbe's number (d-line) of prism	57.4	focal length in meridian direction	f_x=21.86mm

63. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and an anamorphic aspherical surface (AAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}+x^2/r_{xi}}{1+\sqrt{1-\{(1+k_{yi})(y/r_{yi})^2+(1+k_{xi})(x/r_{xi})^2\}}} + AR_i\{(1+AP_i)y^2+(1-AP_i)x^2\}^2+BR_i\{(1+BP_i)y^2+(1-BP_i)x^2\}^3 + CR_i\{(1+CP_i)y^2+(1-CP_i)x^2\}^4+DR_i\{(1+DP_i)y^2+(1-DP_i)x^2\}^5$$

said optical apparatus has the following properties:

	r_{yi}[mm] radius of curvature in generatrix direction	r_{xi}[mm] radius of curvature in meridian direction	y, z coordinates of vertex		tilt angle in generatrix direction	
i=1	∞		(0、0)		0	
2	-2158.074	-32.224	(0.60、19.83)	AAL	-10.55	in prism
3	-63.157	-32.870	(34.76、30.90)	AAL	15.81	in prism
4	-2158.074	-32.224	(0.60、19.83)	AAL	-10.55	in prism
5	72.108	1049.744	(14.82、29.00)	AAL	53.74	in prism
6	∞		(17.03、30.62)		42.91	

(AAL2、4)	$K_{y2,4}$	$K_{x2,4}$	$AR_{2,4}$	$BR_{2,4}$	$CR_{2,4}$	$DR_{2,4}$
	-13763.5	-3.896	-0.170E-4	0.401E-7	-0.154E-9	0.223E-12
			$AP_{2,4}$	$BP_{2,4}$	$CP_{2,4}$	$DP_{2,4}$
			-0.245	0.416E-1	0.870E-1	0.203E-1
(AAL3)	K_{y3}	K_{x3}	AR_3	BR_3	CR_3	DR_4
	1.238	0.279	-0.317E-5	0.248E-8	-0.179E-11	0.608E-15
			AP_3	BP_3	CP_3	DP_3
			0.249	0.327E-2	-0.192E-1	0.181E-1
(AAL5)	K_{y5}	K_{x5}	AR_5	BR_5	CR_5	DR_5
	6.285	-1.33E-6	-0.114E-4	-0.402E-6	0.113E-8	-0.411E-10
			AP_5	BP_5	CP_5	DP_5
			0.273E1	0.155E1	0.160E1	-0.644

refractive index (d-line) of prism 1.49171

Abbe's number (d-line) of prism 57.4

focal length in generatrix direction f_y=23.20mm

focal length in meridian direction f_x=24.09mm

64. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and an anamorphic aspherical surface (AAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}+x^2/r_{xi}}{1+\sqrt{1-\{(1+k_{yi})(y/r_{yi})^2+(1+k_{xi})(x/r_{xi})^2\}}} + AR_i\{(1+AP_i)y^2+(1-AP_i)x^2\}^2+BR_i\{(1+BP_i)y^2+(1-BP_i)x^2\}^3 + CR_i\{(1+CP_i)y^2+(1-CP_i)x^2\}^4+DR_i\{(1+DP_i)y^2+(1-DP_i)x^2\}^5$$

said optical apparatus has the following properties:

	r_{yi}[mm] radius of curvature in generatrix direction	r_{xi}[mm] radius of curvature in meridian direction	y, z coordinates of vertex		tilt angle in generatrix direction	
i=1	∞		(0、0)		0	
2	-3945.723	-49.792	(3.665、20.415)	AAL	0.04	in prism
3	-67.136	-38.803	(36.403、32.01)	AAL	14.60	in prism
4	-3945.723	-49.792	(3.665、20.415)	AAL	0.04	in prism
5	123.302	843.030	(19.610、28.357)	AAL	61.72	in prism
6	∞		(22.402、29.859)		52.54	

(AAL2、4)	$K_{y2,4}$	$K_{x2,4}$	$AR_{2,4}$	$BR_{2,4}$	$CR_{2,4}$	$DR_{2,4}$
	7202.73	-7.709	-0.142E-7	0.379E-7	-0.154E-9	0.198E-12
			$AP_{2,4}$	$BP_{2,4}$	$CP_{2,4}$	$DP_{2,4}$
			-0.183	0.710E-1	0.514E-1	0.201E-1
(AAL3)	K_{y3}	K_{x3}	AR_3	BR_3	CR_3	DR_4
	1.066	0.193	-0.822E-5	0.321E-8	-0.188E-11	0.461E-15
			AP_3	BP_3	CP_3	DP_3
			0.390	0.586E-1	-0.185E-1	-0.222E-1
(AAL5)	K_{y5}	K_{x5}	AR_5	CR_5	DR_5	
	-85.544	-916252	-0.913E-6	-0.204E-9	0.117E-13	-0.227E-10
			AP_5	BP_5	CP_5	DP_5
			0.989E1	0.128E1	0.128E2	-0.952E-1

refractive index (d-line) of prism 1.49171

Abbe's number (d-line) of prism 57.4

focal length in generatrix direction f_y=23.71mm

focal length in meridian direction f_x=23.70mm

65. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and an anamorphic aspherical surface (AAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}+x^2/r_{xi}}{1+\sqrt{1-\{(1+k_{yi})(y/r_{yi})^2+(1+k_{xi})(x/r_{xi})^2\}}} + AR_i\{(1+AP_i)y^2+(1-AP_i)x^2\}^2+BR_i\{(1+BP_i)y^2+(1-BP_i)x^2\}^3 + CR_i\{(1+CP_i)y^2+(1-CP_i)x^2\}^4+DR_i\{(1+DP_i)y^2+(1-DP_i)x^2\}^5$$

said optical apparatus has the following properties:

	r_{yi}[mm] radius of curvature in generatrix direction	r_{xi}[mm] radius of curvature in meridian direction	y, z coordinates of vertex		tilt angle in generatrix direction	
i=1	∞		(0, 0)		0	
2	-3752.581	-50.580	(2.85, 23.13)	AAL	0	in prism
3	-66.938	-38.651	(36.37, 34.72)	AAL	14.15	in prism
4	-3752.581	-50.580	(2.85, 23.13)	AAL	0	in prism
5	306.125	1095.447	(18.59, 31.48)	AAL	69.84	in prism
6	∞		(21.46, 32.54)		51.20	

Cont'd

(AAL2, 4)

K_{y2}, 4	K_{x2}, 4	AR_2, 4	BR_2, 4	CR_2, 4	DR_2, 4
-33820.5	-11.350	-0.144E-4	0.398E-7	-0.153E-9	0.201E-12
		AP_2, 4	BP_2, 4	CP_2, 4	DP_2, 4
		-0.152	0.730E-1	0.494E-1	0.255E-1

(AAL3)

K_{y3}	K_{x3}	AR_3	BR_3	CR_3	DR_4
1.063	0.127	-0.225E-5	0.316E-8	-0.188E-11	0.474E-15
		AP_3	BP_3	CP_3	DP_3
		0.372	0.568E-1	-0.168E-1	-0.208E-1

(AAL5)

K_{y5}	K_{x5}	AR_5	BR_5	CR_5	DR_5
745.334	-651374	-0.656E-6	0.124E-6	0.474E-12	-0.972E-11
		AP_5	BP_5	CP_5	DP_5
		0.837E1	-0.273	0.563E1	-0.538

refractive index (d-line) of prism 1.49171

Abbe's number (d-line) of prism 57.4

focal length in generatrix direction f_y=23.09mm

focal length in meridian direction f_x=23.09mm

66. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and a toric aspherical surface (TAL) and a rotationally symmetrical aspherical surface (AL) are defined by the following equation,

$$z = \frac{y^2/r_{yi}}{1+\sqrt{1-(1+k_i)(y/r_{yi})^2}} + A_i y^4 + B_i y^6 + C_i y^8 + D_i y^{10}$$

where k_i, A_i, B_i, C_i, and D_i are aspherical coefficients,

said optical apparatus has the following properties:

(Visual line detecting system)

	r_{yi} Radius of curvature in generatrix cross section	r_{xi} Radius of curvature in meridian cross section	Vertex coordinate Y, Z	Tilt angle in generatrix cross section		
i= 1	∞		(0, 0)	0 °	eye	
i= 2	-514.575	-52.805	(0, 21.15)	0	TAL	nd=1.49171 νd=57.4
i= 3	-63.546	-42.575	(26.30, 35.96)	-3.33	TAL-M	
i= 4	-514.575	-52.805	(0, 21.15)	0	TAL-M	
i= 5	∞		(20.72, 28.06)	65.37		
i= 6	∞		(21.18, 28.27)	65.37		nd=1.51633 νd=64.1
i= 7	∞		(23.41, 28.20)	30.37	M	
i= 8	∞		(21.18, 28.27)	65.37	M	
i= 9	∞		(24.93, 20.09)	-54.64		
i=10	-1.889		(26.90, 21.14)	-54.64	AL	nd=1.49171 νd=57.4
i=11	1.426		(29.35, 19.41)	-54.64	AL	
i=12	∞		(30.51, 18.95)	-51.60	image sensor	

(Observation system)

i= 8	∞		(23.91, 29.52)	65.37		nd=1.51633 νd=64.1
i= 9	∞		(24.98, 30.01)	59.37	image information	

(TAL, AL data)

TAL2, 4: K=460.670, A=-0.227E-5, B=0.179E-7, C=-0.453E-10, D=0.429E-13

TAL3 : K=1.105, A=-0.709E-6, B=-0.273E-8, C=-0.191E-11, D=0.631E-15

AL10 : K=-3.858, A=0.851E-2, B=-0.101, C=0.149, D=-0.755E-1

AL11 : K=-0.113, A=0.195, B=-0.590, C=0.471, D=-0.138

67. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and a toric aspherical surface (TAL) and a rotationally symmetrical aspherical surface (AL) are defined by the following equation,

$$z = \frac{y^2/r_{yi}}{1+\sqrt{1-(1+k_i)(y/r_{yi})^2}} + A_iy^4 + B_iy^6 + C_iy^8 + D_iy^{10}$$

where k_i, A_i, B_i, C_i, and D_i are aspherical coefficients,

said optical apparatus has the following properties:

(Visual line detecting system)

	r_{yi} Radius of curvature in generatrix cross section	r_{xi} Radius of curvature in meridian cross section	Vertex coordinate Y, Z	Tilt angle in generatrix cross section		
i= 1	∞		(0, 0)	0 °	eye	
i= 2	-514.575	-52.805	(0, 21.15)	0	TAL	nd=1.49171
i= 3	-63.546	-42.575	(26.30, 35.96)	-3.33	TAL	νd=57.4
i= 4	-514.575	-52.805	(0, 34.15)	0	TAL	
i= 5	∞		(0, 37.15)	45	M	
i= 6	-1.889		(-13.0, 37.15)	90	AL	nd=1.49171
i= 7	1.426		(-16.0, 37.15)	90	AL	νd=57.4
i= 8	∞		(-17.27, 37.15)	90	image sensor	

(Observation system)

i= 3	-63.546	-42.575	(26.30, 35.96)	-3.33	TAL-M
i= 4	-514.575	-52.805	(0, 21.15)	0	TAL-M
i= 5	∞		(20.72, 28.06)	65.37	
i= 6	∞		(24.05, 29.59)	54.25	image information

nd=1.51633
νd=64.1

(TAL, AL data)

TAL2, 4: K=460.670, A=-0.227E-5, B=0.179E-7, C=-0.453E-10, D=0.429E-13

TAL3 : K=1.105, A=-0.709E-6, B=0.273E-8, C=-0.191E-11, D=0.631E-15

AL6 : K=-3.858, A=0.851E-2, B=-0.101, C=0.149, D=-0.755E-1

AL7 : K=-0.113, A=0.195, B=-0.590, C=0.471, D=-0.138

68. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and an anamorphic aspherical surface (AAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}+x^2/r_{xi}}{1+\sqrt{1-\{(1+k_{yi})(y/r_{yi})^2+(1+k_{xi})(x/r_{xi})^2\}}} + AR_i\{(1+AP_i)y^2+(1-AP_i)x^2\}^2+BR_i\{(1+BP_i)y^2+(1-BP_i)x^2\}^3 + CR_i\{(1+CP_i)y^2+(1-CP_i)x^2\}^4+DR_i\{(1+DP_i)y^2+(1-DP_i)x^2\}^5$$

and a rotationally symmetrical aspherical surface (AL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}}{1+\sqrt{1-(1+k_i)(y/r_{yi})^2}} + A_iy^4 + B_iy^6 + C_iy^8 + D_iy^{10}$$

where k_i, A_i, B_i, C_i, and D_i are aspherical coefficients,

said optical apparatus has the following properties:

(Visual line detecting system)

	r_{yi} Radius of curvature in generatrix cross section	r_{xi} Radius of curvature in meridian cross section	Vertex coordinate Y, Z	Tilt angle in generatrix cross section		
i= 1	∞		(0, 0)	0 °	eye	
i= 2	-2158.074	-32.224	(0.60, 19.85)	-10.55	AAL	nd=1.49171 νd=57.4
i= 3	-63.157	-32.870	(34.76, 30.92)	15.81	AAL-M	
i= 4	-2158.074	-32.224	(0.60, 19.85)	-10.55	AAL-M	
i= 5	72.108	1049.744	(14.82, 29.02)	53.74	AAL	
i= 6	∞		(14.98, 29.14)	53.74		nd=1.51633 νd=64.1
i= 7	∞		(17.19, 29.51)	18.74	M	
i= 8	∞		(14.98, 29.14)	53.74	M	
i= 9	∞		(20.31, 21.88)	-66.27		
i=10	-1.889		(22.03, 23.31)	-66.27	AL	nd=1.49171 νd=57.4
i=11	1.426		(24.77, 22.10)	-66.27	AL	
i=12	∞		(25.96, 21.91)	-63.23	image sensor	

(Observation system)

i= 8	∞		(17.40, 30.91)	53.74		nd=1.51633 νd=64.1
i= 9	∞		(18.21, 31.50)	44.74	image information	

(AAL, AL data)

AAL2, 4:

Ky=-13763.5, AR=-0.170E-4, BR=0.406E-7, CR=-0.154E-9, DR=0.223E-12

Kx=-3.896, AP=-0.245, BP=0.416E-1, CP=0.870E-1, DP=-0.203E-1

AAL3:

Ky=1.238, AR=-0.317E-5, BR=0.248E-8, CR=-0.179E-11, DR=0.608E-15

Kx=0.279, AP=-0.249, BP=0.327E-2, CP=-0.192E-1, DP=0.181E-1

AAL5:

Ky=6.825, AR=-0.114E-4, BR=-0.402E-6, CR=0.113E-8, DR=-0.411E-10

Kx=-1.33E+6, AP=0.273E+1, BP=0.155E+1, CP=0.160E+1, DP=-0.644

AL10 : K=-3.858, A=0.851E-2, B=-0.101, C=0.149, D=-0.755E-1

AL11 : K=-0.113, A=0.195, B=-0.590, C=0.471, D=-0.138

69. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and an anamorphic aspherical surface (AAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}+x^2/r_{xi}}{1+\sqrt{1-\{(1+k_{yi})(y/r_{yi})^2+(1+k_{xi})(x/r_{xi})^2\}}} + AR_i\{(1+AP_i)y^2+(1-AP_i)x^2\}^2+BR_i\{(1+BP_i)y^2+(1-BP_i)x^2\}^3 + CR_i\{(1+CP_i)y^2+(1-CP_i)x^2\}^4+DR_i\{(1+DP_i)y^2+(1-DP_i)x^2\}^5$$

and a rotationally symmetrical aspherical surface (AL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}}{1+\sqrt{1-(1+k_i)(y/r_{yi})^2}} + A_iy^4 + B_iy^6 + C_iy^8 + D_iy^{10}$$

where k_i, A_i, B_i, C_i, and D_i are aspherical coefficients,

said optical apparatus has the following properties:

(Visual line detecting system)

	r_{yi} Radius of curvature in generatrix cross section	r_{xi} Radius of curvature in meridian cross section	Vertex coordinate Y, Z	Tilt angle in generatrix cross section		
i= 1	∞		(0, 0)	0 °	eye	
i= 2	-9423.260	-47.769	(0, 20.38)	1.50	AAL	nd=1.49171 νd=57.4
i= 3	-65.701	-36.469	(33.13, 29.99)	14.29	AAL-M	
i= 4	-9433.260	-47.769	(0, 20.38)	1.50	AAL-M	
i= 5	7188.930	-49.971	(16.33, 26.54)	62.55	AAL	
i= 6	∞		(19.89, 27.27)	21.55	M	
i= 7	-1.889		(21.28, 20.34)	-11.45	AL	nd=1.49171 νd=57.4
i= 8	1.426		(21.88, 17.39)	-11.45	AL	
i= 9	∞			-8.45	image sensor	
(Observation system)						
i= 7	∞		(21.11, 29.03)	55.43	image information	

(AAL, AL data)

AAL2, 4:

Ky=-361850, AR=-0.183E-4, BR=0.381E-7, CR=-0.114E-9, DR=0.153E-12

Kx=-13.802, AP=-0.317, BP=-0.602E-1, CP=0.272E-1, DP=-0.211E-1

AAL3:

Ky=1.227, AR=-0.209E-5, BR=0.308E-8, CR=-0.190E-11, DR=0.505E-15

Kx=0.172, AP=0.472, BP=0.553E-1, CP=-0.865E-1, DP=0.751E-2

AAL5:

Ky=987000, AR=-0.871E-5, BR=-0.264E-6, CR=0.469E-13, DR=0.137E-11

Kx=-70.169, AP=41.763, BP=-0.395, CP=0.183E+2, DP=-0.988

AL7 : K=-3.858, A=0.851E-2, B=-0.101, C=0.149, D=-0.755E-1

AL8 : K=-0.113, A=0.195, B=-0.590, C=0.471, D=-0.138

70. An optical apparatus according to claim 27, wherein when a radius of curvature in generatrix direction (y direction) and a radius of curvature in meridian direction in the i-th surface counted from the observer's eyeball are r_{yi} and r_{xi}, respectively, and an anamorphic aspherical surface (AAL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}+x^2/r_{xi}}{1+\sqrt{1-\{(1+k_{yi})(y/r_{yi})^2+(1+k_{xi})(x/r_{xi})^2\}}} + AR_i\{(1+AP_i)y^2+(1-AP_i)x^2\}^2+BR_i\{(1+BP_i)y^2+(1-BP_i)x^2\}^3 + CR_i\{(1+CP_i)y^2+(1-CP_i)x^2\}^4+DR_i\{(1+DP_i)y^2+(1-DP_i)x^2\}^5$$

and a rotationally symmetrical aspherical surface (AL) is defined by the following equation,

$$z = \frac{y^2/r_{yi}}{1+\sqrt{1-(1+k_i)(y/r_{yi})^2}} + A_iy^4 + B_iy^6 + C_iy^8 + D_iy^{10}$$

where k_i, A_i, B_i, C_i, and D_i are aspherical coefficients,

said optical apparatus has the following properties:

(Visual line detecting system)

	r_{yi} Radius of curvature in generatrix cross section	r_{xi} Radius of curvature in meridian cross section	Vertex coordinate Y, Z	Tilt angle in generatrix cross section		
i= 1	∞		(0, 0)	0 °	eye	
i= 2	-9538.246	-47.590	(0, 21.30)	7.28	AAL	nd=1.49171 νd=57.4
i= 3	-65.6	-36.035	(32.96, 31.40)	14.67	AAL-M	
i= 4	-9538.246	-47.590	(0, 21.30)	0.28	AAL-M	
i= 5	225.188	727.642	(16.47, 28.45)	65.28	AAL	
i= 6	∞		(16.92, 28.60)	67.28		nd=1.51633 νd=64.1
i= 7	∞		(19.15, 28.51)	35.28	M	
i= 8	∞		(16.92, 28.66)	67.28	M	
i= 9	∞		(19.69, 29.82)	67.28	M	
i=10	∞		(23.55, 20.60)	-167.72		
i=11	1.889		(21.38, 20.05)	-167.72	AL	nd=1.49171 νd=57.4
i=12	-1.426		(20.74, 17.12)	-167.72	AL	
i=13	∞		(20.19, 16.01)	-164.69	image sensor	nd=1.51633 νd=64.1

(Observation system)

i= 8	∞		(19.69, 29.82)	67.28	
i= 9	∞		(22.02, 29.17)	54.10	image information

(AAL, AL data)

AAL2, 4:

Ky=-387540, AR=-0.183E-4, BR=0.378E-7, CR=-0.117E-9, DR=0.158E-12

Kx=-20.897, AP=-0.300, BP=-0.548E-1, CP=0.326E-1, DP=-0.228E-1

AAL3:

Ky=1.213, AR=-0.224E-5, BR=0.305E-8, CR=-0.190E-11, DR=0.500E-15

Kx=0.165, AP=-0.464, BP=0.630E-1, CP=-0.251E-1, DP=0.380E-2

AAL5:

Ky=559.028, AR=-0.675E-5, BR=0.182E-6, CR=0.212E-12, DR=-0.189E-10

Kx=-99429.4, AP=0.486E+1, BP=-0.125E+1, CP=0.111E+2, DP=-0.789

AL11 : K=-3.858, A=0.851E-2, B=-0.101, C=0.149, D=-0.755E-1

AL12 : K=-0.113, A=0.195, B=-0.590, C=0.471, D=-0.138

71. An optical apparatus according to any of claims 27, 28, 46 through 55, and 62 through 70, wherein the following condition is met:

$$1.421 \leq R_{y2}/R_{x2} \leq 1.921.$$

72. An optical apparatus according to 71, wherein the following condition is met:

R_{y2}/R_{x2}=1.421, 1.921, 1.730, 1.732, 1.493, 1.921, 1.802 or 1.820.

73. An optical apparatus according to claim 72, wherein the following condition is met:

(a) R_{y2}=-57.595 and R_{x2}=-40.526;

(b) R_{y2}=-63.157 and R_{x2}=-32.870;

(c) R_{y2}=-67.136 and R_{x2}=-38.803;

(d) R_{y2}=-66.738 and R_{x2}=-38.651;

(e) R_{y2}=-63.546 and R_{x2}=-42.575;

(f) R_{y2}=-63.157 and R_{x2}=-32.870;

(g) R_{y2}=-65.701 and R_{x2}=-36.469; or

(h) R_{y2}=-65.600 and R_{x2}=-36.035.

74. An optical apparatus according to any of claims 27, 28, 46 through 55, and 62 through 70, wherein the XZ-plane passes through the vertex of said second surface and is perpendicular to the tangent at the vertex.